National Transportation Safety Board
Washington, DC 20594

Brief of Accident

Adopted 03/30/2004

DEN02GA085
File No. 15092 | 07/30/2002 | Estes Park, CO | Aircraft Reg No. N3978Y | Time (Local): 18:43 MDT

Make/Model:	Aerospatiale / SA315B
Engine Make/Model:	Turbomeca / Artouste IIIB
Aircraft Damage:	Destroyed
Number of Engines:	1
Operating Certificate(s):	On-demand Air Taxi; Aircraft External Load
Type of Flight Operation:	Public Use
Reg. Flight Conducted Under:	Public Use

	Fatal	Serious	Minor/None
Crew	1	0	0
Pass	0	0	0

Last Depart. Point:	Estes Park, CO
Destination:	Boulder, CO
Airport Proximity:	Off Airport/Airstrip

Condition of Light:	Day
Weather Info Src:	Weather Observation Facility
Basic Weather:	Visual Conditions
Lowest Ceiling:	12000 Ft. AGL, Broken
Visibility:	40.00 SM
Wind Dir/Speed:	160 / 017 Kts
Temperature (°C):	33
Precip/Obscuration:	None / None

Pilot-in-Command Age: 52

Certificate(s)/Rating(s)
Commercial; Single-engine Land; Helicopter
Instrument Ratings
Helicopter

Flight Time (Hours)

Total All Aircraft:	7730
Last 90 Days:	200
Total Make/Model:	900
Total Instrument Time:	90

The helicopter was engaged in fire suppression activities. As the pilot made an approach for a water drop, witnesses said the engine made a "high-pitch whine," there was "a loud pop," they saw the rotor blades "slowing down," and heard the blades making a "thump, thump, thump" sound. The pilot was heard to say he was "going down." Witnesses reported seeing purple or blue flames shooting 2 to 3 feet from the exhaust stack. After the helicopter struck the ground and rolled over, witnesses heard the engine spooling down and saw flames coming from the engine "like a blowtorch." A post-impact ground fire, confined to the cockpit area, was quickly extinguished. An examination of the helicopter engine revealed evidence of heat distress aft of the labyrinth seal. The turbine section had a "corn cob" appearance. The first and second stage nozzles showed heat damage. The third stage nozzle was totally destroyed. According to the engine manufacturer, the turbine blades were exposed to "around 1,000 degrees C., about 400 degrees C. beyond the normal operating temperature over a short period of time." According to "Helicopter Aerodynamics," if the rate of descent exceeds 1/4 of the hover induced velocity, the flow conditions are such that the air is going both up and down through and around the rotor in a disorganized and unsteady manner. This is called vortex ring state. It exists until the helicopter is descending at about twice the hover-induced velocity. In the vortex ring state, the helicopter pilot may find himself in the unusual situation where pulling up the collective pitch does not slow the rate of descent. This is known as settling with power. The pilot has entered "a flight condition where the required power is more than the available power." According to the Artouste IIIB Training Manual, engine rotation (nominal) speed is 33,500 rpm, plus or minus 200 rpm. The fuel control unit maintains this speed. If a load is placed on the engine, the fuel-metering valve opens, fuel flow increases, and engine torque increases. Variation from this speed must not exceed 1,000 rpm. The time it takes to return from a speed variation to the nominal engine rotation speed is less than 4 seconds.

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Occurrence #1: LOSS OF ENGINE POWER(PARTIAL) - MECH FAILURE/MALF
Phase of Operation: MANEUVERING - AERIAL APPLICATION

Findings
1. (C) COLLECTIVE - ABRUPT - PILOT IN COMMAND
2. (F) VORTEX RING STATE - ENCOUNTERED - PILOT IN COMMAND
3. (F) SETTLING WITH POWER - INADVERTENT - PILOT IN COMMAND
4. (F) ALTITUDE - LOW
5. TURBINE ASSEMBLY - OVERTEMPERATURE
6. TURBINE ASSEMBLY - MELTED

Occurrence #2: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: DESCENT - UNCONTROLLED

Findings
7. ROTOR RPM - LOW

Occurrence #3: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Findings
8. TERRAIN CONDITION - MOUNTAINOUS/HILLY

Findings Legend: (C) = Cause, (F) = Factor

The National Transportation Safety Board determines the probable cause(s) of this accident as follows.
the pilot's abrupt collective input during water application to a forest fire. Contributing factors were encountering a vortex ring state, the inadvertent settling with power, the low altitude, and the mountainous terrain.